

## Compensated Neutron (CNL) Tool



The Compensated Neutron (CNL) tool measures the hydrogen content of the formation surrounding the wellbore. The hydrogen content is related to porosity, and can be used for gas detection in combination with other tools in both open and cased hole applications.

### Description

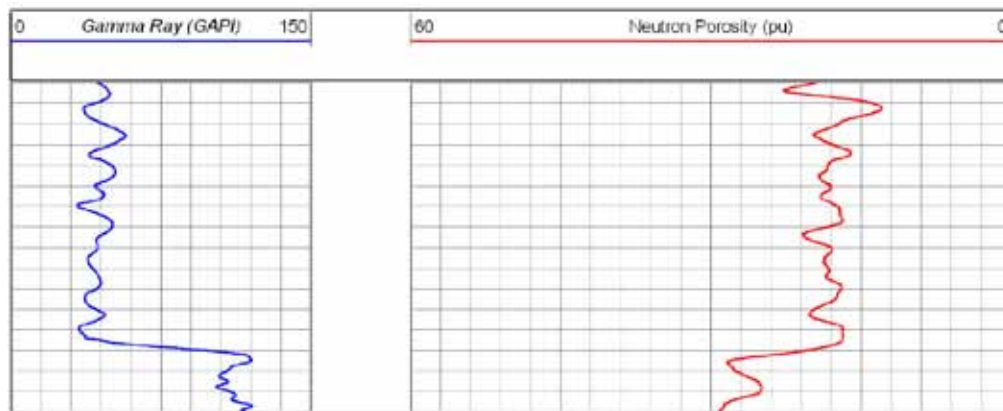
The CNL tool contains a neutron emitting source producing fast neutrons that bombard the formation. The emitted neutrons are thermalized by collisions with other nuclei. The hydrogen nuclei are considered the chief moderator of neutrons, thus porosity is measured based on the hydrogen content of the formation. Some of the thermalized neutrons are scattered back to the tool where they are counted by two neutron detectors filled with He-3 gas. The detectors are spaced at fixed distances from the source to compensate for hole rugosity and borehole effects. The porosity measurement consists of counting the number of neutrons reaching the detectors and relating them to the pore space in the rock.

Typical uses for the CNL tool are:

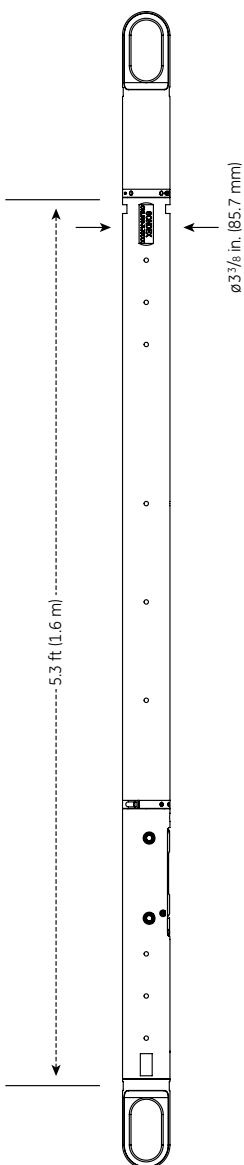
- Porosity measurement
- Lithological identification
- Clay analysis
- Gas detection

### Features

- Can be run in both open and cased hole environments
- Fully compatible with Sondex Ultrawire\* tools
- Modeled for both AmBe and Cf neutron sources
- Industry-leading neutron detectors with excellent signal-to-noise ratio, gamma discrimination, and shock and vibration ratings



# Compensated Neutron (CNL) Tool



Specifications	
Maximum OD	3 <sup>3</sup> / <sub>8</sub> in. (85.7 mm) 5 in. (127 mm) with eccentricizer
Makeup length	5.3 ft (1.6 m)
Weight	125 lb (57 kg)
Maximum temperature	302°F (150°C)
Maximum pressure	20 kpsi (137.9 Mpa)
Minimum hole	6 in. (152 mm)
Maximum hole	16 in. (406 mm)
Tensile strength	50,000 lb (22,700 kg)
Compressive strength	7,500 lb (3,550 kg)
Sensor Offsets	
SS Detector	1.71 ft (0.52 m)
LS Detector	2.23 ft (0.68 m)
Borehole Conditions	
Borehole fluids	Salt, fresh, oil
Maximum logging speed	33 ft/min (10 m/min)
Tool position	Eccentralized
Measurement	
Accuracy	0–20 pu +/- 1 pu
	20–30 pu +/- 2 pu
	30–60 pu +/- 6 pu
Vertical resolution	2.0 ft (0.61 m)
Depth of investigation	Dependent on hydrogen index
Measurement range	0–60 pu limestone units
Primary curves	Limestone porosity, sandstone porosity, dolomite porosity
Hardware and Power Requirements	
Tool bus	Ultrawire*
Power	75 mA (18V DC)



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